Benchmark Numerical Toolkits for High Performance Computing, Phase I

Completed Technology Project (2009 - 2010)

Project Introduction

Computational codes in physics and engineering often use implicit solution algorithms that require linear algebra tools such as Ax=b solvers, eigenvalue, optimization, or graph algorithms. Developers face major challenges in selecting linear algebra tools that can support their algorithms, numerical schemes, meshes, and computing hardware and to minimize the time, space and complexity. The existing libraries such as PETSc or LAPACK are "stretched" to the limits by new generation application codes which create big, unsymmetric, often dense, and poorly conditioned matrices. One of the obstacles in effective utilization of linear algebra libraries is lack of benchmark quality representative test cases and benchmarking toolkits for these types of problems. This project will develop, demonstrate and deliver a comprehensive numerical test suite for benchmark evaluation of linear algebra solvers for computational application software on High Performance Computers. Unlike existing benchmarks on static, Ax=b matrix, problems CFDRC-TACC team proposes new generation of dynamic, discipline specific and multidisciplinary functional benchmarks accounting for sparse/dense and unsymmetric matrices using web accessible benchmark matrix/problem generators. Our team has excellent expertise and tools (multiphysics solvers, sparse/dense solver libraries, benchmark cases, related projects, and understanding of NASA engineering/scientific challenges) as well as HPC resources to achieve this goal.

Primary U.S. Work Locations and Key Partners
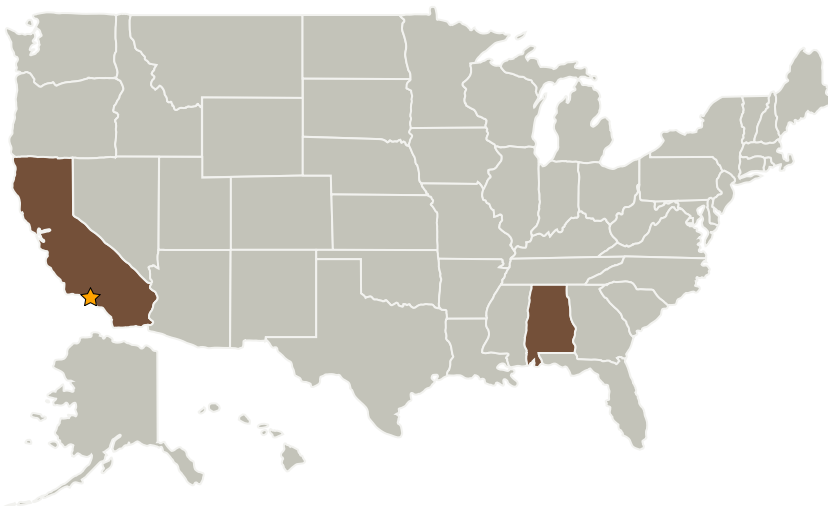
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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/10255

Organizations Performing Work	Role	Type	Location
⭐Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California

Project Transitions

▶ **January 2009:** Project Start

✔ **January 2010:** Closed out

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Ravi Kannan

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  └ TX11.6 Ground Computing
    └ TX11.6.2 Automated Exascale Software Development Toolset